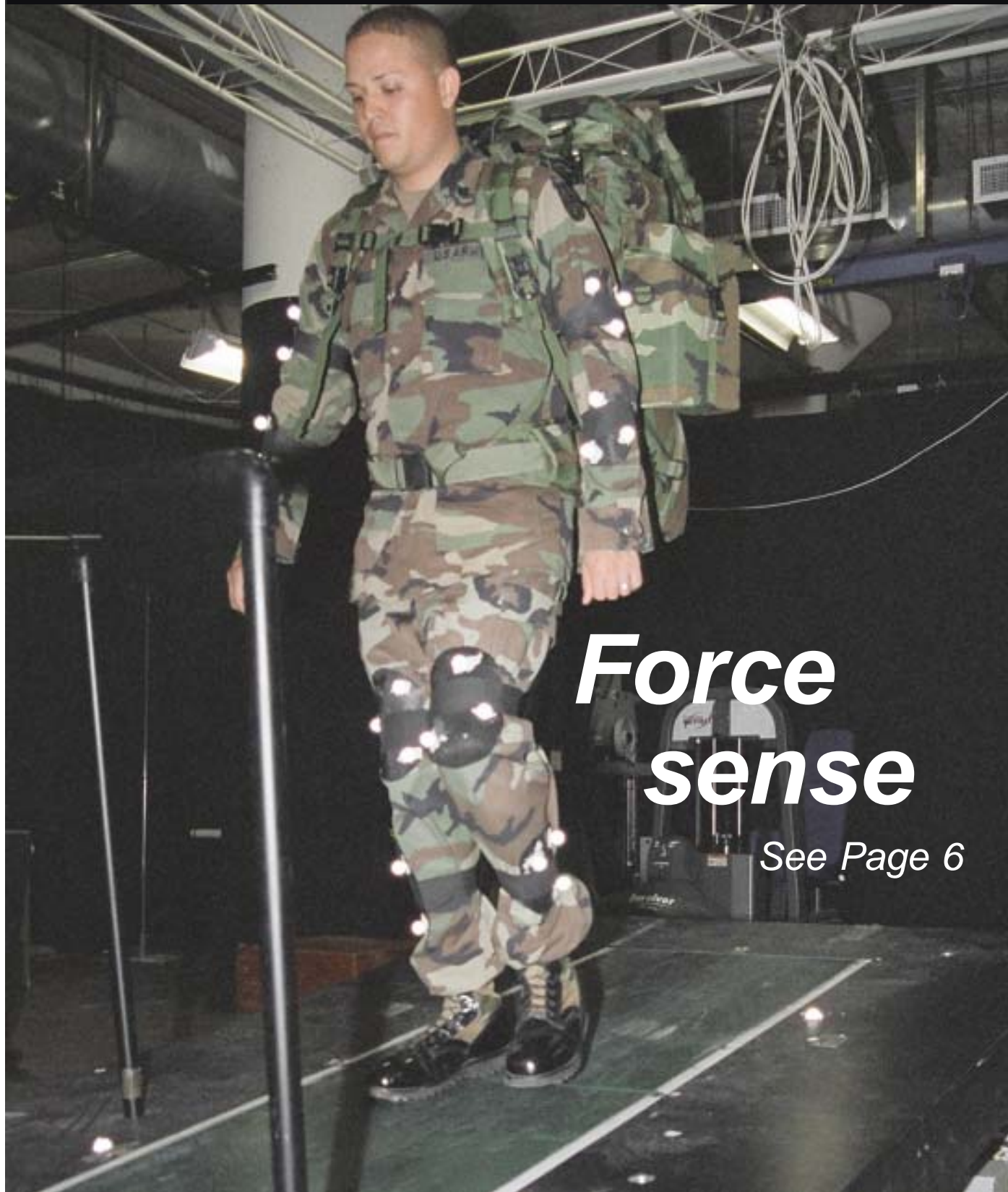




THE WARRIOR

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Cover photo: Spc. Hipolito Ramos walks on the Force Sensing Treadmill in the Center for Military Biomechanics Research. (Warrior/Biberdorf)



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HooAH! goes commercial

By Curt Biberdorf
Editor

It's "all go, no crash" for HooAH! The performance nutrition bar first developed for the military has taken its "SteadyEnergy" blend to the commercial market.

HooAH! was created in 1996 by the Department of Defense Combat Feeding Directorate at the U.S. Army Soldier Systems Center in Natick, Mass., through a Cooperative Research and Development Agreement (CRADA) with M&M Mars, Inc., to increase energy and improve performance of warfighters during intense military operations.

After a slow start, the bars are gaining a regular and widespread distribution in the military supply chain. HooAH! is now a component of the CarboPack, and beginning next year, will be in several Meal, Ready-to-Eat (MRE) menus. A smaller HooAH! will be part of the First Strike Ration scheduled for fielding in 2007, pending approval from the military services.

About a year ago, D'Andrea Brothers, LLC in Los Angeles, Calif., approached Combat Feeding to produce the bar for commercial sales, which had been unsuccessfully attempted in previous years as a way to expand its distribution, according to Gerald Darsch, Combat Feeding director.

A federally-registered trademark of the Army, HooAH! was licensed by D'Andrea Brothers for commercial sales.

By the end of 2004, the company introduced the commercial bar in silver, red, white and blue packaging—a change from the woodland camouflage for the military—in limited markets for anyone to enjoy. By June, the bars will be stocked at retail stores nationwide. Bars also can be ordered online at www.hooahbar.com.

"The commercial prospects are very big," said Christian D'Andrea. "Retailers are really pumped and think that it's the next big bar. Everyone respects the military, and everybody wants a part of that cutting-edge technology."

Before the HooAH! bar, researchers learned there was a demand for the product as Soldiers were buying whatever performance nutrition bars were available, said Darsch.

"The prevailing thought was that to be good, it must have to taste bad," Darsch said. "In addition to the less-than-acceptable flavor, most energy bars didn't have the shelf life. We wanted something to bring value to the warfighter."

Combat Feeding started from scratch, looking for the right combination of simple sugars, complex carbohydrates and fat. The military HooAH! bar consists mainly of corn syrup, rice crisp blended with corn for texture, dried fruit, partially hydrogenated cottonseed or soybean oil, maltodextrin, flavor-specific ingredients and vitamins.

"When we formulated it for energy, we wanted to provide a quick increase in blood glucose and then a

slow release of energy," said Jack Briggs, senior food technologist and HooAH! bar inventor. "Very key in this is lipids. They give it shelf life, texture, taste and energy. At the time of initial development, our studies had shown the HooAH! bar to be superior to anything else on the market as far as acceptability."

The military operational requirement for ration storage is a minimum of three years at 80 degrees F or six months at 100 degrees F, which presents a challenge not faced by other nutrition bars. It's another reason for a higher fat content.

"Most commercial bars become hard as a rock over time," Briggs said. The current formulation has an ideal amount of fat to provide a stable, palatable food that has a firm but crunchy texture.

"We'd get comments from people saying that a lot of the ingredients are similar (to other bars)," Darsch said. "It's not what's in there. It's how much of that is in there."

He said the primary goal was to give warfighters energy with as close to 100 percent acceptability as possible, and with enough testing and evaluation, they ended up with a high-quality, good-tasting product. As with everything coming out of Combat Feeding, HooAH! is warfighter tested and approved.

Even the name, which is Army-speak derived from "heard, understood and acknowledged," was overwhelmingly agreed upon by Soldiers during surveys, according to Darsch. Marines use the term Oorah!, and he said the bar issued in the MRE will be split label with HooAH! on one side and Oorah! on the other to cater to both services.

The military HooAH! bar comes in apple-cinnamon, chocolate, cran-raspberry, peanut butter and raspberry flavors while the commercial version is offered in apple-cinnamon and chocolate crisp, with more flavors to be introduced later, starting with peanut butter.

The commercial bar has 280 calories, 10 grams of soy and whey protein, 9 grams of non-hydrogenated palm oil, 40 grams of simple and complex carbohydrates, and 17 vitamins and minerals.

A portion of the proceeds from every bar sold commercially is returned to the Combat Feeding Directorate to help fund the Army's research into enhancing Soldier safety, diet and quality of life.



Warrior/Underhill

Sling loaded

Pendant improved for external helicopter cargo delivery

By Curt Biberdorf
Editor

Whipping sand was wearing down pendants, grinding its fibers and causing a potential breakage problem for helicopters flown by the 101st Airborne Division in sling load operations.

Within months, the Natick Soldier Center's Aerial Delivery and Engineering Support Team at the U.S. Army Soldier Systems Center in Natick, Mass., along with manufacturers developed a quick improvement for the sand-filled experience of Iraq.

"When we originally developed the pendant, we knew sand could be a problem, especially in a rapid development situation," said Scott Ullery, project officer for the revised

pendant. "Sand can get into the fibers while lying on the ground or as it stretches in the air. The sand particles can be very sharp and cut core fibers in ways you can't see."

He said testing of the 40-foot pendants used in the desert revealed up to a 40 percent loss in strength due to sand degradation.

"The idea of a pendant is not new per se. Units in Alaska have done it before, but there are drawbacks to the systems used," Ullery said. "With potential regular use in a desert environment, it warranted taking a look to bring in new technology for a formal system."

Two years ago, the 101st Airborne Division (Air Assault) funded the pendant program to relieve them of the problems associated with sling load operations, according to Ullery. Pendants attach to existing slings and enable helicopters hovering over cargo during sling load hookup to land, easing the task for pilots and ground troops.

"Even in the best of conditions, it's difficult to hover and stay steady," said Ullery. "When it's windy, it's even worse. In the desert, you get brownout or whiteout in the snow, and it's harder for pilots to remain in position without a visual reference. If it's really bad, it can be difficult to see the load as they fly in."

Meanwhile, a Soldier risks getting struck as he connects the sling standing on top of or beside the cargo, and without another Soldier to connect a metal discharge line, could get zapped by static electricity. Furthermore, once the load is ready to go, it's difficult or impossible for those troops to board the helicopter, necessitating other arrangements.

With the ability to land next to the cargo because of what amounts to extra sling length, the pendant reduces the static electricity and collision hazards, and allows ground troops to fly on the same helicopter



A Chinook helicopter sling loads a tactical vehicle with twin hooks connected to a pendant. (Courtesy photos)

that is carrying their equipment.

Time on the pickup zone is reduced because the process is more predictable, Ullery said, and a group of helicopters is less likely to be slowed down by one delayed sling load. For extra distance away from the load, two pendants can be joined. A swivel prevents twisting of the pendant on single-point loads.

Sling loading of military equipment and cargo is accomplished with either Chinook or Blackhawk helicopters in light infantry units.

Ullery said it allows troops to move quickly in and out of a dangerous area and to carry items too big to fit inside the helicopter. Depending on weather and altitude, Blackhawks can lift up to 9,000 pounds of vehicles, weapons or pallets of supplies, while the larger Chinooks can transport more than 20,000 pounds.

Four 12-foot double-braided nylon slings from the cargo are linked to the helicopter on either a single center hook or twin hooks fore and aft, found on Chinooks, for extra stability and easier flying.

Besides extra training, the tradeoff with a pendant is increased height of hover when pilots want to fly as close to the ground as possible. Ullery said considerations for the improved pendant design included compact size, low weight and low stretch, but the most important features of the new design are strength and durability.

Responsible for sling load certification for all military helicopters, the Aerial Delivery and Engineering Support Team investigated different possibilities for an improved pendant, first looking at the original double-braided polyester 40-foot pendant with a 12,500-pound capacity used by the 101st during their last deployment.

The revised version is a more rugged 50-foot length with a 15,000-pound capacity, increased resistance to sand wear and tear, and required 75,000 pound minimum breaking strength.

A blowing sand test in March was performed in the McKinley Climatic Laboratory at Eglin Air Force Base, Fla., on two candidate pendants and an unused 40-foot pendant.

Ullery said good results of the sand and strength testing have permitted the project to move ahead into production. Once testing is complete, the final design will be selected. As many as 1,200 pendants will be purchased for immediate fielding.



A swivel prevents twisting of the pendant on single-point loads (above). A pendant connected to a Humvee is ready for sling load delivery. (Courtesy photos)



Dual belts on the Force Sensing Treadmill gather 3-D force data separately for each foot.

Force sense

Dual-belt force-platform treadmill advances gait studies

Story and photos by Curt Biberdorf

Each foot gets individual attention on the Force Sensing Treadmill, a newly-patented design invented by research physiologists at the U.S. Army Research Institute of Environmental Medicine (USARIEM).

Built by Advanced Mechanical Technology Inc. of Watertown, Mass., the treadmill features one rolling belt in front of another, each with its own independent force platform attached to a common chassis.

The treadmill gathers more and higher quality data during gait studies in much shorter time than traditional methods, said Peter Frykman, who along with Everett Harman and Michael LaFiandra invented the treadmill as an upgrade to the existing force platform used in the Center for Military Biomechanics Research, a facility shared by USARIEM and the Natick Soldier Center at the U.S. Army Soldier Systems Center in Natick, Mass.

"The new force-platform tread-

mill is a unique tool that addresses the gait biomechanics of marching Soldiers," Frykman said. "During previous gait studies, the test subjects had to step on the force plate just right. That made it very hard to walk naturally. In addition, you had to assume that what was happening on the right foot was happening to the left foot as well."

The idea of joining two separate rolling belts on a treadmill has been attempted, but they were positioned laterally to each other rather than fore-aft, said Harman.

Because the left and right foot tends to cross over or overlap the body's midline as each lands, he said that design makes it impossible to walk naturally while keeping each foot on a separate belt.

By positioning the two rolling belts front and back moving at the same speed, separate information on the 3-D forces and torques on each foot can be collected during walking or running the entire time either foot is in contact with the belt.

"If you stand on a scale to measure your weight, you can't determine what pressure each foot is exerting," Frykman said, illustrating how a single-belt force-platform treadmill can't do the job. "(With this treadmill), you're never situated where both feet are on the same belt at the same time. To get a good analysis, you need to know the force on each foot separately."

Frykman said data collection from each foot is especially important while walking because during part of the stride, both feet are touching the ground at the same time. That is when a single force platform under a treadmill belt cannot tell how much of the total force is on each foot.

Computer post-processing produces independent time records of the forces on each foot with the new treadmill. The computerized system records thousands of data points per second captured by the force-platform treadmill and video cameras for later analysis, assisted by reflective

markers worn by test subjects.

In five minutes of testing, researchers can now collect more information than when conducting many trials over several hours using a conventional force platform.

Knowing the magnitude and direction of forces on the feet as well as body motion information recorded with high-speed video cameras allows researchers to use computerized mathematical models to calculate the forces and torques at the ankles, knees, hips and the other major body joints, said Harman.

How rucksacks, boots, or clothing affect posture and gait are examples of the types of studies conducted in the biomechanics laboratory for the military.

Large universities conducting biomechanics studies and hospitals with gait analysis labs for medical diagnosis and physical rehabilitation are potential customers for the new

treadmill, which the Army hopes to license to Advanced Mechanical Technology Inc., Frykman said.

The treadmill bed looks and feels like a conventional treadmill except for a sliver of space between the front and rear belts, which doesn't disrupt normal walking. Maximum speed is 11 mph, and hydraulic lifts adjust the platform up to a 25 percent uphill or downhill grade without stopping the belt or test subject. Bed capacity is 400 pounds to accommodate larger test subjects and their cargo load, and a removable handrail clears the view of the lab's cameras.

Several heavy cables connect the force-platform treadmill to the control panel, which is necessary to operate its high-precision motors, according to Frykman. The whole gait analysis system can be moved to another location if necessary. "We couldn't get the same data or the



A control panel adjusts the treadmill's speed and grade.

tremendous time savings without the new force-platform treadmill. Those are the factors that make it the great scientific tool it is," Harman said.



Spc. Hipolito Ramos walks on the Force Sensing Treadmill in the biomechanics lab. Hydraulic lifts adjust the platform up to a 25 percent uphill or downhill grade without stopping the belt or test subject.

Pocket stove

Capillary force vaporizer revolutionizes burner technology

By Curt Biberdorf
Editor

Once you hear the slight puff and see the yellow flame mellow into a glowing blue, you know the capillary force vaporizer has gone into action.

The vaporizer is a breakthrough in burner technology being applied to the Modular Individual Water Heater, a jointly developed product of the Department of Defense Combat Feeding Directorate's Equipment and Energy Technology Team at the U.S. Army Soldier Systems Center in Natick, Mass., and Mountain Safety Research (MSR), a division of Cascade Designs, Inc. in Seattle, Wash.

Trioxane fuel bars had been the source for warfighters to heat water for beverages, dehydrated rations and personal hygiene, but there were drawbacks and production has been discontinued, said Leigh Knowlton, project officer.

"Soldiers had supply problems because they're considered fuel and ordered separately from food. It will also evaporate if the seal is broken in storage and can give off noxious

fumes when burned," he said.

Knowlton said little has changed in the last 40 years in this area of warfighter sustainment. Current authorized equipment to heat water consists of a plastic canteen, steel cup, cup stand and cover. Absent the fuel bar, the alternative is the military's squad stove, a commercial product that has an external fuel tank with a pump to build pressure and prime the stove.

"It's heavy because of the bottle, has a lot of moving parts, it's expensive, and it's not about efficiency—it blasts out heat," Knowlton said. "If you can use less fuel, that's less fuel to carry."

Meal, Ready-to-Eat (MRE) rations have a flameless heater for the entrée and upcoming pouches to make hot beverages, but there's still a void for the dried foods found in the Long Range Patrol/Cold Weather Ration, which require 28-40 ounces of hot water for all the components. He said the situation will worsen if the canteen cup is phased out because of the increasing popularity of bladder hydration systems.

With no existing commercial stove or water heater that's lightweight, compact, compatible with on-the-move hydration systems and meets the military's requirement to burn JP-8 fuel, the capillary force vaporizer invented by Vapore, Inc. in Richmond, Calif., became the solution.

Three-part wick

About the size and shape of a pair of antacid tablets, the three-layer vaporizer held together by an impermeable exterior glaze has no moving parts and fits inside a cone-shaped stove where it converts liquid fuel into a pressurized gas. Knowlton said the vaporizer is durable as well, working for hundreds of hours before wearing out.

A coarse ceramic layer at the bottom is the feed wick that touches the fuel. In the middle is the boiler wick, a fine ceramic layer that generates high capillary pressure and vaporizes the fuel. On top is the orifice disk that conducts heat from the flame to the boiler wick and has one or more pinhole-sized openings to expel fuel vapor.

"Because there's no pressurized tank, it's potentially safer. If something goes wrong, it just goes out," Knowlton said. "MSR is excited because this is their route to a revolutionary product."

As configured in the current prototype, the stove is unpacked from its own commercial steel mug, but Knowlton said a sack may become available so it can be carried independently.

Starting it is as simple as holding the stove upside down for 30 seconds for priming, turning it upright and lighting the priming wick with an MRE match. Within 60 seconds, the capillary force vaporizer takes over, emitting a whooshing blue flame. A sliding steel lever with off, simmer and full settings regulates output.

The mug filled with water is



Warrior/Biberdorf

A hot water coil that attaches to the top of the stove's pot support and windscreen was developed to easily heat water from hydration packs.

placed on the stovetop pot support and windscreen. Knowlton said the commercial cup, which is designed to improve heat transfer efficiency, could be offered for the military version, or the system may be modified to accommodate canteen cups.

Another heat transfer system is the hot water coil, which was developed to easily heat water from hydration packs.

Once described as resembling an elephant stethoscope, a flexible plastic tube connects to the water bladder and feeds water to a metal heat exchanger that attaches onto the pot support and windscreen. A valve inside the heat exchanger releases hot water through another tube that can be directed into a dehydrated meal or beverage pouch.

With either method, a pint of water is heated in six to 10 minutes. The stove system has twice the energy efficiency of a squad stove, burns JP-8 and holds enough fuel in its tank to last for three days, Knowlton said.

Cold weather Army and Marine Corps units are likely early adopters, according to Knowlton, although all the services have shown interest. MSR plans on selling a white-gas version of the stove as part of their product line of outdoor recreational gear.

Combat Feeding and MSR built the stove under a cost-sharing contract, and the technology base could lead to more products.

"The vaporizer technology has interesting applications beyond stoves," Knowlton said. "Vapore is leaning toward medical devices. But for military applications, it has potential for anything that needs a small amount of vaporized fuel, and that's challenging to do with JP-8."

Beverage chillers, personnel warmers, lanterns, generators for individual warfighter equipment and infrared markers are examples of small heat-driven devices for the military.

Knowlton said more research is going into the hot water coil and mug to increase their efficiency and reduce weight. The commercial stove will be ready next year, with the military version possibly being fielded in limited quantities before commercial sales.



Warrior/Biberdorf

A commercial mug filled with water is placed on the stovetop pot support and windscreen. The cup is designed to improve heat transfer efficiency. It could be offered for the military version, or the system may be modified to accommodate canteen cups.



Warrior/Biberdorf

The three-layer capillary force vaporizer, held next to the stove, is bonded together by an impermeable exterior glaze and has no moving parts.

System aids combat medics

By Karen Fleming-Michael
Contributing Writer

FORT DETRICK, Md. — Medics on the not-so-distant battlefield may get assistance with the triage of injured Soldiers from a new system called Warfighter Physiological Status Monitoring.

WPSM allows remote triage of injured Soldiers using leading-edge technology, like electronic textiles.

"The medic will remotely know who's been injured and who he should go to first vs. what we do now (which) is have the medic run to and find an injured Soldier, not knowing if another individual is in worse shape just 20 yards to the left," said Col. Beau Freund of the U.S. Army Research Institute of Environmental Medicine at the U.S. Army Soldier Systems Center in Natick, Mass.

"There's only one medic per a large group of Soldiers, so (WPSM can) provide situational awareness so a medic knows who is hurt and perhaps the extent of their injuries, so he can make some informed decisions about where he should be to save lives," Freund said.

A group of experts in physiology, engineering, electronics and textiles is developing WPSM for the Future Force Warrior, an Army science and technology initiative. The team, Freund said, is on schedule to deliver a system in 2006 that at a minimum must be able to detect if a Soldier is alive or has received a ballistic impact.

On the preventive medicine side, the WPSM system also needs to be able to detect how much fluid the Soldier is drinking and if the Soldier is in danger of a heat injury, Freund said.

Future Force Warrior, Freund said, "is looking at what is possible and what capabilities we might be able to add to our warfighters in the near future. Let's build some systems, test them and pick from the cream of the crop which ones we want to include now and which ones will require future development."

The WPSM system has three aims. The system, first, should reduce combat morbidity and mortality by providing a medic situational awareness about the health status of his warfighters.

It's "providing a toolkit for (the medic) to make assessments and decisions," said Freund. "Essentially it tells if a Soldier has likely survived an injury or not. That does two things: One, it helps prioritize for the medic who he should go to, and two, it keeps the medic out of harm's way from rendering aid to someone who hasn't survived."

Preventive medicine is the system's second component. By monitoring fluid intake, body temperature and heart rate, the WPSM system can provide an idea of who is likely to become a heat casualty.

"Rather than just 'Johnny's hurt and here's his heart rate,' the system can give a medic early on indications about somebody who may be in trouble," Freund said.

The third aim of the system is giving commanders a snapshot about the overall health of his Soldiers so he can make informed decisions.

"To cross the road there's a certain risk. What do we get out of crossing that road now vs. waiting? Many of our tools simply provide information for (the commander) to do some risk assessment and make decisions," Freund said. "We're not just looking at the medical solutions to help a medic, but we're providing commanders and operational unit leaders with situational understanding that will help them do their jobs. It's much bigger than the medical piece."

Editor's note: Karen Fleming-Michael serves with the U.S. Army Medical Research and Materiel Command Public Affairs Office.



Courtesy photo

The Warfighter Physiological Status Monitoring System has six components that send their data signal to a main hub. 1) Fluid Intake Monitor 2) Life Sign Detection System 3) Sleep Performance Watch 4) Biomedical Information System-Tactical 5) Medical Hub 6) Core Temperature Ingestible Sensor.

Shelters, shop vans restored

By Maj. Rich Hall
Contributing Writer

TOBYHANNA ARMY DEPOT, Pa.— Electronics repair shelters and vans are being restored to like-new condition through a joint effort of the Army's Electronic Shop Van Recapitalization Program.

Product Manager Force Sustainment Systems (PM FSS), Tobyhanna Army Depot, Communication-Electronic Life Cycle Management Command (C-E LCMC), and the Army's Office of the Deputy Chief of Staff are the key players in the program that also is incorporating several reliability and supportability initiatives as well as safety fixes.

PM FSS, located at the U.S. Army Soldier Systems Center in Natick, Mass., has overall responsibility and oversight of the program to recapitalize AN/ASM-146 and AN/ASM-147 shelters and AN/ASM-189 and AN/ASM-190 vans used as the primary maintenance facilities for the entire Army electronics maintenance mission for combat service support.

They provide a sheltered facility for bench testing, repair and calibration of avionics, communication, electronic, navigation, photographic and infrared systems. Upgrades include improvements to power ser-



Courtesy photo

Stephen Krushnowski, an electrician in Tobyhanna Army Depot's Systems Integration Directorate, installs a surge arrestor in an AN/ASM-146 Maintenance Shelter.



Courtesy photo

Electronics repair shelters at Tobyhanna Army Depot undergo reconditioning through the Army's Electronic Shop Van Recapitalization Program.

vice and signal interface components, and U. S. Army Combined Arms Support Command recommendations.

These enhancements will improve efficiencies and maintenance capabilities for the Soldier maintainer, and provide an Electronic Maintenance Shop that will support the Two-Level Maintenance Concept.

PM FSS manages the cost, schedule and performance of the program. Working closely with the Office of the Deputy Chief of Staff, they draft the order for the fiscal year Electronic Shop Van Recapitalization inductions and fielding schedule. Tobyhanna Army Depot technicians rebuild the shelters and vans and C-E LCMC executes the fielding plan.

Tobyhanna Army Depot has been involved in this program since its inception, initially producing the modification work order and new technical manuals. Shelters and vans are completely disassembled, and sheetmetal is replaced or repaired, tested for leaks and painted.

Systems Integration and Support Directorate technicians manufacture several new racks, straps and braces to support upgrades to shelter and van systems. As part of the power service improvements, three-phase power was added, requiring re-wiring of the entire van or shelter.

Other upgrades were improved power entrance box connectors, Single Channel Ground and Air Ra-

dio System antenna interfaces, and run-time meters. Access to a Local Area Network and remote telephone connections are now available.

At the onset of the recapitalization program, Army leadership decided to limit the number of vans identified for recapitalization to 957 of the 2,750 total worldwide based on the minimum number of systems to support the Army's "First to Fight" force, now modular brigades and Stryker Brigade Combat Teams, not the total force. This partial fleet quantity is to serve as a bridge to an undetermined Training and Doctrine Command modernization program plan.

Tobyhanna Army Depot has completed a total of 442 vans and shelters through January 2005. The C-E LCMC has executed fieldings at 12 sites, giving warfighters 328 recapitalized assets. Five additional unit fieldings are scheduled for this fiscal year.

Recapitalized systems are then fielded to active Army and National Guard units based upon deployment or other priorities.

The recapitalization program began full production in Fiscal Year 2003 and is scheduled to continue through 2007. The program's goal is to reduce the average worldwide electronic shop fleet age from 24.5 years to 18.2 years by 2012.

Editor's Note: Maj. Rich Hall is PM FSS assistant Product Manager for Shelter Systems.



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